

ASSIGNMENT 06

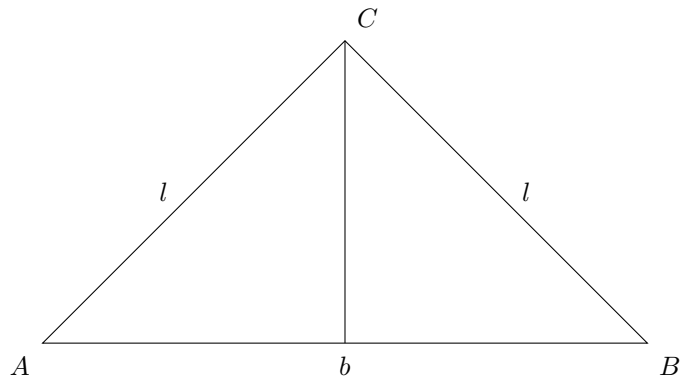
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January 22, 2021

• **Question 2.67:**

The two equal sides of an isosceles triangle with fixed base b are decreasing at the rate of 3cm per second. How fast is the area decreasing when the two equal sides are equal to the base.

Solution:



Let the two sides of the isosceles triangle be $= l$.

$\text{Base} = b = \text{constant}(\text{given})$

Also, the rate at which the two sides are decreasing $= dl/dt = 3\text{cm}$.

Now, By Pythagoras Theorem,

$$l^2 = (b/2)^2 + p^2$$

$$\text{or, } p = \sqrt{l^2 - (b^2/4)}$$

$$\text{Now, Area of triangle} = A = 1/2(p * b).$$

$$\text{or, } A = 1/2(\sqrt{l^2 - b^2/4}) * b.$$

$$\text{or, } dA/dt = 1/2 * (b/2\sqrt{l^2 - b^2/4} * 2l(dl/dt)).$$

$$\text{or, } dA/dt = (1/2)bl/\sqrt{l^2 - b^2/4} * 3. \quad (\text{since } dl/dt = 3\text{cm})$$

$$\text{or, } dA/dt = (1/2)b^2/\sqrt{b^2 - b^2/4} * 3. \quad (\text{as } l = b)$$

$$\text{or, } dA/dt = (3/2)b * 2/\sqrt{3}.$$

$$\text{or, } dA/dt = \sqrt{3} * b\text{cm}^2/s.$$

• **Question 2.68:**

A tank with rectangular base and rectangular sides, open at the top is to be constructed so that its depth is 2 m and volume is 8m^3 . If building of tank costs Rs 70 per square meters for the base and Rs 4 per square meter for sides. What is the cost of least expensive tank.

Solution:

Given, volume of tank = 8m^3 .

Depth of the tank = 2m .

Cost of building the base of tank is Rs 70/sq mtrs and Rs 4/sqr mtr for building sides.

Let x, y and z be the length, breadth and depth of the tank respectively.

$$\text{Volume} = x * y * 2 = 8\text{m}^3.$$

$$\text{or, Volume} = 2 * x * y = 8.$$

$$\text{or, } x * y = 4.$$

Now, Curved Area of tank = $A_c = 2(2 * x + 2 * y)$.

$$A_c = 2(2 * x + 2 * y).$$

or, $A_c = 4(x + y)$.

$$A_c = 4(x + 4/x). \quad (\text{since } y = 4/x)$$

Hence, Total cost of Curved sides = $4(x + 4/x) * 45 = T_c$.

or, $dT_c/dx = 4(1 - 4/x^2) * 45 = 0$.

or, $x^2 - y = 0$.

or, $x = \pm 2$.

i.e, $x = 2$.

or, $y = 2$.

Hence, total cost = $(4 * 70 + 45 * 4(2 + 2))$.

or, total cost = $(280 + 360)$.

or, total cost = $Rs640$.